the third epitaxial layer **14** and a fourth epitaxial layer **15** are shown below. As the dopant, diborane (B_2H_6) gas in concentration of 100 ppm was used.

[0096] The temperature of the atmosphere during formation of the second epitaxial layer was 970° C. and the dopant gas flow rate was 220 sccm. The temperature of the atmosphere during formation of the third epitaxial layer was 950° C. and the dopant gas flow rate was 250 sccm. The temperature of the atmosphere during formation of the fourth epitaxial layer was 980° C. and the dopant gas flow rate was 210 sccm.

[0097] Thereafter, resistivity of the semiconductor substrate **1** obtained by the steps S**1** to S**5** was measured and electrical characteristics thereof were evaluated using spreading resistance measurement device. In Example 1, variation in resistivity profile in a thickness direction (for example, maximum value−minimum value) was no greater than ±2%.

Comparative Example 1

[0098] Unlike Example 1, the dopant gas flow rate in an atmosphere during the third epitaxial layer forming step S**4** was 220 sccm. Other conditions were the same as in Example 1. In Comparative Example 1, variation in resistivity profile in a thickness direction was ±11%.

[0099] Evaluation results of Example 1 and Comparative Example 1 show the following, for example. Example 1 provided resistivity profile in a thickness direction more uniform than in Comparative Example 1. In other words, the dopant concentration of each of the second epitaxial layer, the third epitaxial layer and the fourth epitaxial layer does not change significantly and is substantially the same. Accordingly, Example 1 was found to provide the electrical characteristics that are suitable for production of a MOSFET having a super junction structure.

EXPLANATION OF REFERENCE NUMERALS

[0100] **1** Semiconductor substrate
[0101] **10** Silicon substrate
[0102] **11** First epitaxial layer
[0103] **12** Trench
[0104] **13** Second epitaxial layer (epitaxial layer)
[0105] **14** Third epitaxial layer (epitaxial layer)
[0106] **15** Fourth epitaxial layer (epitaxial layer)
[0107] S**1** First epitaxial layer forming step
[0108] S**2** Trench forming step
[0109] S**3** Second epitaxial layer forming step (epitaxial layer forming step)
[0110] S**4** Third epitaxial layer forming step (epitaxial layer forming step)
[0111] S**5** Fourth epitaxial layer forming step (epitaxial layer forming step)

1. A method of producing a semiconductor substrate, the method comprising:

a first epitaxial layer forming step of forming a first epitaxial layer by introducing a dopant gas of a first conductivity type to a semiconductor substrate of the first conductivity type;

a trench forming step of forming a trench in the first epitaxial layer; and

an epitaxial layer forming step of forming an epitaxial layer of a second conductivity type that is different from the first conductivity type on the first epitaxial layer and in the trench so as to fill up the trench, using a plurality of growth conditions including different growth rates, and making concentration of a dopant gas of the second conductivity type, which is incorporated into the epitaxial layer, constant in each of the plurality of growth conditions.

2. The method of producing a semiconductor substrate according to claim **1**, wherein: the plurality of growth conditions includes growth temperature of the epitaxial layer;

and the growth rate is changed by changing the growth temperature of the epitaxial layer.

3. The method of producing a semiconductor substrate according to claim **1**, wherein: the plurality of growth conditions includes flow rate of the dopant gas of the second conductivity type that is introduced into the epitaxial layer and the trench; and the growth rate is changed by changing the flow rate of a material gas.

4. A method of producing a semiconductor substrate, the method comprising:

a first epitaxial layer forming step of forming a first epitaxial layer by introducing a dopant gas of a first conductivity type to a semiconductor substrate of the first conductivity type;

a trench forming step of forming a trench in the first epitaxial layer; and

a second epitaxial layer forming step of forming a second epitaxial layer on the first epitaxial layer and in the trench, by introducing a dopant gas of a second conductivity type that is different from the first conductivity type at a predetermined first dopant gas flow rate, in an atmosphere of a predetermined first temperature;

a third epitaxial layer forming step of forming a third epitaxial layer to fill up the trench, by introducing the dopant gas of the second conductivity type to the second epitaxial layer at a second dopant gas flow rate that is greater than the first dopant gas flow rate, in an atmosphere of a second temperature that is lower than the first temperature;

a fourth epitaxial layer forming step of forming a fourth epitaxial layer by introducing the dopant gas of the second conductivity type to the second epitaxial layer and the third epitaxial layer at a third dopant gas flow rate that is lower than the second dopant gas flow rate, in an atmosphere of a third temperature that is higher than the second temperature.

5. A method of producing a semiconductor substrate, the method comprising:

a first epitaxial layer forming step of forming a first epitaxial layer by introducing a dopant gas of a first conductivity type to a semiconductor substrate of the first conductivity type;

a trench forming step of forming a trench in the first epitaxial layer;

a second epitaxial layer forming step of forming a second epitaxial layer on the first epitaxial layer and in the trench, by introducing a dopant gas of a second conductivity type that is different from the first conductivity type at a predetermined first dopant gas flow rate, in an atmosphere of a predetermined first temperature; and

a third epitaxial layer forming step of forming a third epitaxial layer to fill up the trench, by introducing the dopant gas of the second conductivity type to the second epitaxial layer at a second dopant gas flow rate that is